

Musculoskeletal disorders and disability in persons aged 85 and over: a community survey

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Abstract

Objectives—To study the prevalences of musculoskeletal disorders and disability in the elderly, and the relationship between them.

Methods—A community sample of 73 females and 32 males aged 85 and over underwent a standardised examination at home. Musculoskeletal disorders were classified according to published clinical criteria. The relative effects on disability (a walking distance of <500 m or dependency in activities of daily living (ADL)) of musculoskeletal disorders and comorbidity were analysed by logistic regression.

Results—Musculoskeletal pain was reported by 57% of those interviewed. A major restriction of joint movement range was frequent in the shoulder but uncommon in other joints. A shoulder disorder was found in 27% of subjects, rheumatoid arthritis in 1% and osteoarthritis (OA) of the hand, hip, and knee in five, seven, and 18% of subjects, respectively. Disability was frequent: a walking distance of <500 m was found in 60% and ADL dependency in 40% of the group. Factors related to one or both of these disability measures included female gender, hip and knee OA, impaired vision, cognitive impairment and neurological disease.

Conclusion—Musculoskeletal pain and disorders, in addition to disability were frequent in this very elderly population. However, as a cause of disability, other disorders were at least as important as musculoskeletal disorders.

suggest that self reported disability is more frequent than objective assessment of functional limitations would predict,¹¹ especially in very elderly individuals with cognitive impairment.¹² The true prevalence of musculoskeletal disorders in the elderly and the extent to which they cause physical disability are uncertain, but 25–50% of those aged 85 and more have been reported to have limitations of basic physical abilities, depending on the definitions used.^{3–5} The rapid increase in the absolute number of these very elderly subjects in the industrialised countries has major implications in terms of provision of care.

We investigated the prevalence of musculoskeletal pain and disorders and their association with physical disability in a cross-sectional health survey of people aged 85 and over in the general Dutch population. The modifying effect of comorbidity was taken into account.

Methods

STUDY SUBJECTS

The study formed part of a community survey in persons aged 85 years and over by the Section of Gerontology of Leiden University. The town of Leiden is a community of approximately 105 000 inhabitants; the elderly inhabitants are an ethnically homogeneous group. The names and addresses of all inhabitants aged 85 years or more on 1 August 1990 were obtained from the civic register (total number 1468; 1103 females, 365 males, median age 88 years, range 85–105). From the alphabetically ordered list a random sample of 368 was drawn by selecting every fourth person. With approval of the Committee for Medical Ethics of the Leiden University Hospital, these 368 persons were invited in random order, by a letter and a telephone call, to participate in a health survey. Sixty six had died before the first contact could be made and 63 did not wish to participate. The remaining 239 were visited at home by a physician (KVDB). The first visit comprised a medical history, questionnaire regarding activities of daily life (ADL) and tests of vision and cognition to assess the presence of disability and comorbidity (as defined below). When necessary, the history and the questionnaire were completed with the help of the main caregiver. Every second one of the 239 elderly was asked to permit another visit, by a rheumatologist (DVS) (the others were recruited for a study on lung disease). Fourteen

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The prevalence of both arthritis and physical disability increases with age to a peak in the most elderly.^{1–5} Arthritis has been reported to be the major cause of physical disability in the aged,^{6–9} although several other conditions may contribute to the decreasing physical ability of elderly people, such as dementia, cardiovascular disease and loss of sensory functions.^{8–10}

Large community surveys generally document the presence of 'arthritis' by means of self report, but the definition of arthritis applied by a respondent to a questionnaire may differ from what a physician would classify as a musculoskeletal disorder. Also, sparse data

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(12%) did not wish to be visited again and one died before the second visit. The remaining 73 females and 32 males were included in the present study. Their median age was 89 years (range 85–100). Forty-five of them (43%) lived in a home for the elderly and five (5%) in a nursing home. In the Netherlands, inhabitants of a home for the elderly receive assistance if necessary, but otherwise live independently. Inhabitants of nursing homes receive full nursing care. Fifty-five of the group (52%) lived independently with or without their family. Visits were made between 1 January 1991 and 15 May 1992. The median interval between the two visits was seven days.

MUSCULOSKELETAL EXAMINATION

The visit by the rheumatologist comprised a history and physical examination of the musculoskeletal system. Participants were asked if, during most days of the preceding month, they had experienced pain in seven areas of the body listed (table 1). Answers were scored positive or negative without reference to intensity. The presence and duration of morning stiffness were recorded. Spinal mobility was measured as the change in distance C7–S1 between standing upright and at maximal active flexion of the spine. The passive range of motion of the right shoulder, hip and knee was measured with a two arm goniometer; only forward flexion of the shoulder was measured actively. Reference values were obtained from a publication of the American Academy of Orthopaedic Surgeons.¹³ Shoulder flexion was measured with the 0° plane parallel to the upper thoracic spine, as values relative to a vertical plane from the shoulder downwards would lead to erroneously low values in subjects with kyphosis. The intra- and interobserver reliability of joint range of movement measurements has been shown to be high.¹⁴

MUSCULOSKELETAL DISORDERS

In the circumstances of our study it was not possible to obtain radiographs, so participants were classified according to published clinical criteria, for rheumatoid arthritis (American Rheumatism Association (ARA) criteria),¹⁵ past polyarthritis with joint deformity ('New York' criteria),¹⁶ past polyarthritis without joint deformity ('benign polyarthritis'),¹⁷ and OA of the hand,¹⁸ hip,¹⁹ and knee.²⁰ Persons with current synovitis who did not fulfil the criteria for rheumatoid arthritis were classified as having oligoarthritis. The prevalence of OA of the hand, hip, or knee was determined using a classification based on clinical criteria alone.^{18–20} Shoulder disorders were classified according to Chard *et al.*²¹ A frozen shoulder was defined as a restriction of at least 50% of the normal range of motion of passive forward flexion, glenohumeral abduction, exorotation or endorotation in the absence of arthritis or bony restriction. Rotator cuff tendinitis was defined as the presence of a painful arc of motion on abduction or pain during resisted

abduction, exorotation, or endorotation. OA of the glenohumeral joint was diagnosed if there was bony crepitus in this joint in the absence of synovitis.

Other conditions elicited by history and physical examination were classified according to diagnostic recommendations in standard textbooks of rheumatology.

DISABILITY

Two disability measures were used, representing function of the lower extremity and overall independent function. Walking disability was defined as a walking distance of <500 m, derived from asking how far a person walked outside at least twice a month. Overall independent function was measured with the Katz ADL index, excluding reference to incontinence.²² ADL dependency was defined as receiving human assistance in any of the activities.

COMORBIDITY

Comorbidity factors were: impaired vision, impaired cognition, neurological disease, impaired oxygenation, and obesity. Impaired vision was defined as a vision of less than 0.5 in the Jaeger eye test,²³ cognitive impairment as a score of 0–23²⁴ on the mini mental state examination (MMSE) scale of 0–30.²⁵ Neurological disease was defined as the presence of one or more of: history of cerebrovascular accident or trauma to the central nervous system with persistent paresis, history of Parkinsonism, history of epilepsy. Impaired oxygenation was scored in the presence of heart disease (New York Heart Association class >1), pulmonary disease (more than slight dyspnoea on exertion), or intermittent claudication. Obesity was defined by a body mass index ≥ 27 kg/m², with body weight measured with a digital scale and height estimated on the basis of arm length measurements using a nomogram.²⁶

STATISTICAL ANALYSIS

Differences between groups were tested with the χ^2 test and the Mann-Whitney *U* test, as appropriate (tables 1–3). In a bivariate analysis (χ^2 test) (table 4), the following factors were tested for their relation to the measures of disability: age (90+ *v* 85–89), gender, presence of OA of the hip or the knee, presence of a shoulder disorder, comorbidity items, and musculoskeletal pain at the appropriate site. A multivariate logistic regression analysis (SPSS program) was performed to determine the relative contribution to disability of the various measures of morbidity. Results were expressed as odds ratios with 95% confidence intervals (table 5); pain items were then added to the model one at a time to examine whether they provided an additional explanation for the presence of disability.

Finally, for both disability measures the number of persons was counted without any of the morbidity or pain items. To this end,

cognitive impairment was divided into severe (MMSE score ≤ 17) and mild (MMSE score 18–23).²⁴

Results

HISTORY OF BACK OR JOINT PAIN

Back pain or joint pain, or both, was present in 57% of the group (females 62%, males 47%) (table 1). Pain was most frequently in the back, shoulder, and knee. For several joints, women reported pain more often than men, but the difference was statistically significant only for the wrist and hand. Morning stiffness lasting one hour or more was recorded in 2% of the group.

Table 1 Prevalence of current back or joint pain

Pain localisation	Females (n = 73) (%)	Males (n = 32) (%)	Total (n = 105) (%)
Thoracolumbar spine	28	28	28
Shoulder	29	19	26
Elbow	4	6	5
Hand and wrist	18*	3	13
Hip	12	12	12
Knee	26	19	24
Foot and ankle	10	0	7

*p < 0.05 compared with males.

Table 2 Spinal mobility and range of motion of the right shoulder, hip, and knee

Site	Normal value†	Females (n = 73)	Males (n = 32)	Total (n = 105)
Spinal mobility (cm)	10	7 (2)	8 (2)	7 (2)
ROM (degrees)				
Shoulder: forward flexion, active	180	131 (35)	135 (33)	133 (34)
Shoulder: forward flexion, passive	180	147 (25)	150 (19)	148 (23)
Shoulder: exorotation	90	79 (16)	80 (13)	79 (15)
Shoulder: endorotation	90	79 (17)	73 (19)	77 (17)
Shoulder: glenohumeral abduction	90	83 (11)	84 (11)	83 (11)
Hip: flexion	120	115 (8)	117 (8)	116 (8)
Hip: flexion contracture	0	6 (16)	1 (6)	4 (14)
Hip: abduction	—	34 (12)*	38 (8)	35 (11)
Hip: endorotation	—	31 (14)*	24 (11)	29 (13)
Hip: exorotation	—	46 (15)	44 (13)	45 (14)
Knee: flexion	135	126 (11)*	130 (15)	127 (13)
Knee: flexion contracture	0	4 (15)	1 (4)	3 (12)

†Obtained in healthy young adults;¹³ other results are mean(SD). ROM = Range of motion.

*p < 0.05 compared with males.

Table 3 Prevalence of musculoskeletal disorders

Disorder	Females (n = 73)	Males (n = 32)	Total (n = 105)
	n (%)	n (%)	n (%)
Polyarthritis			
Rheumatoid arthritis	1 (1)	—	1 (1)
Past polyarthritis with joint deformity	2 (3)	1 (3)	3 (3)
Past polyarthritis without joint deformity	2 (3)	—	2 (2)
Oligoarthritis	7 (10)	5 (16)	12 (11)
Osteoarthritis			
Hand	5 (7)	—	5 (5)
Hip	4 (6)	3 (9)	7 (7)
Hip prosthesis† (1 or 2 sides)	10 (14)	1 (3)	11 (11)
Total:	14 (19)	4 (13)	18 (17)
Knee	14 (19)	5 (16)	19 (18)
Knee prosthesis† (2 sides)	1 (1)	—	1 (1)
Total:	15 (21)	5 (16)	20 (19)
Shoulder disorders			
Frozen shoulder	12 (16)	6 (19)	18 (17)
Osteoarthritis	3 (4)	1 (3)	4 (4)
Synovitis	3 (4)	—	3 (3)
Rotator cuff tendinitis	3 (4)	—	3 (3)
Bicipital tendinitis	1 (1)	—	1 (1)
Acromioclavicular luxation	—	1 (3)	1 (1)
Any shoulder disorder	20 (27)	8 (25)	28 (27)

Osteoarthritis and shoulder disorders were scored independently of the presence of poly- or oligoarthritis. Differences between sexes not significant. †The indication for surgery was OA in all cases.

MUSCULOSKELETAL EXAMINATION

Table 2 shows spinal mobility and the mean range of movement of large joints. Any restriction of joint motion was mostly slight, except for the shoulder, in which active forward flexion of 120° or less was present in 31% of subjects. Hip flexion of less than 90° was not found; flexion contracture of the hip of 15° or more was present in 11% of the group. One percent of the group had knee flexion of less than 90° and 9% had a flexion contracture of the knee of 15° or more.

PREVALENCE OF MUSCULOSKELETAL DISORDERS

Six persons had suffered or still suffered from polyarthritis. The age at onset varied from 41 years to 87 years (median 75). In two subjects the arthritis had subsided without joint deformity (benign polyarthritis), and three others no longer had active arthritis but had residual joint deformity (New York criteria); active rheumatoid arthritis (ARA criteria) was present in only one. Oligoarthritis was found in 12 persons (table 3), at the shoulder (n = 2), wrist (n = 1), metacarpophalangeal joints (n = 3), proximal interphalangeal joints (n = 1), and knee (n = 7). One person had one-sided arthritis of the metacarpophalangeal joints in conjunction with the clinical picture of polymyalgia rheumatica. Five of seven subjects with monoarthritis of the knee were also classified as having OA of the knee.

Prevalence of OA was low; more females than males had OA, but the difference was not statistically significant (table 3).

A shoulder disorder was present in 27% of the group (table 3). Two of these had both synovitis with bicipital tendinitis, and frozen shoulder with rotator cuff tendinitis. A frozen shoulder, the most frequent shoulder disorder (18 subjects), was bilateral in four; in another four the frozen shoulder was associated with stroke (three) and fracture of the humerus (one).

Sixty eight percent of those with knee pain had a diagnosis of knee OA; approximately 50% of those with pain at the shoulder, hand, or hip, had a joint disorder.

In no subject was there clinical evidence of other major musculoskeletal disorders such as gout or spondylarthropathy.

DISABILITY

There was a high level of disability in this population: 60% walked less than 500 m outdoors alone and 40% received human assistance in performing daily activities. Bivariate analysis revealed significant association with one or both of the disability measures, for female gender, OA of the knee, a shoulder disorder, impaired vision, impaired cognition and knee pain per se (table 4).

After multivariate analysis (table 5), most of the associations did not change substantially. However, adjusting for the presence of the other factors resulted in a stronger association of neurological disease with walking <500 m, impaired vision was now no longer significantly

Table 4 Bivariate analysis of variables possibly related to two measures of disability

	Overall frequency† (%)	Walks			ADL		
		<500 m (n = 63) (%)	≥500 m (n = 42) (%)	Odds ratio	Dependent (n = 42) (%)	Independent (n = 63) (%)	Odds ratio
Age 90 and over	44	51	33	2.1	52	38	1.8
Female gender	70	78	57	4.7*	81	62	2.6*
Morbidity measures							
OA hip	7	10	2	4.3	7	6	1.1
OA knee	18	29	2	16.4*	21	16	1.4
Shoulder disorder	27	–	–	–	38	19	2.6*
Impaired vision	29	37	17	2.9*	49	16	5.0*
Impaired cognition	46	60	24	4.9*	67	32	4.3*
Neurological disease	15	21	7	3.4	21	11	2.2
Impaired oxygenation	19	22	14	1.7	12	24	0.4
Obesity	25	26	24	1.1	20	29	0.6
Pain							
Pain back	28	33	21	1.8	21	33	0.5
Pain shoulder	26	–	–	–	17	31	0.4
Pain hip	13	14	10	1.5	14	11	1.3
Pain knee	24	32	12	3.3*	26	23	1.2

– Not tested. †Differences between sexes were not significant.

*p < 0.05.

Table 5 Results of logistic regression analysis of two measures of disability, expressed as odds ratios with confidence intervals

	Walks <500 nm OR (95% CI)	ADL dependent OR (95% CI)
Age 90 or over	2.1 (0.7 to 6)	1.8 (0.6 to 5)
Female gender	5.1 (1.5 to 17)	4.4 (1.3 to 15)
OA hip	15.7 (0.9 to 270)	0.8 (0.2 to 4)
OA knee	27.8 (2.6 to 302)	1.6 (0.5 to 6)
Shoulder disorder	–	2.1 (0.7 to 7)
Impaired vision	1.8 (0.5 to 6)	5.1 (1.5 to 18)
Impaired cognition	5.1 (4.7 to 15)	2.8 (1.02 to 8)
Neurological disease	8.9 (1.4 to 56)	1.9 (0.4 to 10)
Impaired oxygenation	1.6 (0.4 to 6)	0.4 (0.1 to 1.7)
Obesity	0.6 (0.2 to 2)	0.3 (0.1 to 1.2)

associated with walking <500 m, and a shoulder disorder was no longer associated with ADL dependency. Inclusion of pain items had little effect on results for other variables in the model, and none of the pain items was significantly related to disability in the multivariate analysis (data not shown).

Twenty per cent of walking disability and 19% of ADL dependency could be explained by the morbidity measures in the model. None of the morbidity or pain items was present in 8% of subjects with a walking disability and 12% of those with ADL dependency. If cognitive impairment was included only when severe, these values became 19 and 21%, respectively.

Discussion

In this community survey of people aged 85 years and over, slightly more than half reported back or joint pain. Moderate restrictions of joint movement range compared with the norm in young adults were quite common. The most prevalent musculoskeletal disorders were knee OA and frozen shoulder. Physical disability was also frequent. Strong independent associations with one or both of the disability measures (walking <500 m and ADL dependency) were found for female gender, hip and knee OA, impaired vision, cognitive impairment, and neurological disease.

The 57% prevalence of back or joint pain in the present study is similar to that of 54% found in the United Kingdom⁴ and slightly greater than the 39% found in Sweden²⁷ in the same age group. Restricted movement ranges

of the shoulder, hip, and knee were more frequent and more severe in the present study population (average age 90) compared with a Swedish cohort of 79 year olds,²⁸ reflecting considerable loss of range after the age of 79. Two other surveys from the United Kingdom reported loss of shoulder flexibility in subjects older than 74 compared with that in a group aged 65–74.^{29–30} However, in a study in which subjects were selected for good health,³¹ there was no loss of range of movement in a group aged 75–84 as compared with that in a group aged 60–69. This suggests that a decrease in joint movement range is not a consequence of ageing itself but rather of age-related increase in diseases.

The prevalence of polyarthritis was low, as has been reported before in this age group.^{32–33} Rheumatoid arthritis was rare in this group; it is unlikely that this observation was distorted by our lack of access to rheumatoid factor tests and radiographs. The prevalence of OA also was low in this population, particularly when compared with that predicted by radiographic studies.³⁴ This arises from the American College of Rheumatology (ACR) requirement that pain be a symptom if OA is to be diagnosed by clinical criteria alone. These criteria for OA were developed in a clinical setting, in which all patients studied had pain. However, it has been found before that only 50% of subjects with radiographic evidence of OA are symptomatic,³⁵ and it appears that, in community surveys, the requirement to include pain in criteria for diagnosis of OA makes the approach insufficiently sensitive to detect OA.³⁶

The frequency of shoulder disorders in this age group has only recently become recognised.^{21–30–31–37–38} In the current survey, pain and a relatively more restricted movement were more prevalent in the shoulder than in the hip or knee. The most frequent shoulder disorder was frozen shoulder, but the majority of those with this condition were asymptomatic and the cause of the restriction was mostly uncertain. Previously, rotator cuff tendinitis was recognised as the most usual shoulder disorder, but in those reports younger populations were studied.^{21–30}

Disability in the elderly may be related to various diseases. Previous studies of adults aged 55 and over showed that the degree of disability is augmented considerably when musculoskeletal disorders occur in association with other chronic conditions.³⁹ In the present study in a group aged 85 and over, cognitive impairment appears to be the most important exacerbating factor, followed by impaired vision, neurological disease and OA of the hip or the knee. Other factors that we did not measure must also play a part in causing the disability we observed, as the morbidity measures studied were able to explain only around 20% of the variation in disability. The multifactorial nature of disability which we found suggests that the role of musculoskeletal disorders in causing disability at very advanced ages is less important than is generally inferred from self reported data in younger populations.⁶⁻⁹

Disability in the elderly is a consequence of disease or disuse, or both. Whatever the cause, it may be expected that some, at least, of the disabled persons are capable of functional improvement—in particular those without recognisable morbidity. In recent years, successful training programmes have led to improvement of muscle function and reduced ADL dependency in elderly patients with knee OA,⁴⁰ and in those resident in homes for the elderly.⁴¹

In summary, the most frequent musculoskeletal findings in this survey were a severe restriction of the range of movement of the shoulder, and knee OA. Disability was determined by several disorders within and without the musculoskeletal system. In several of the disabled persons there was no apparent clinical cause, suggesting the possibility that a considerable increase in physical ability could be achieved in this elderly group.

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